US Army Corps of Engineers

# PUBLIC NOTICE

US Army Corps of Engineers
New York District
ATTN: Harbor Programs Branch (Hawkins)
26 Federal Plaza, Room 2119
New York, N.Y. 10278-0090

**In replying refer to:**
Public Notice Number: FP62-SAN1b-2007
Issue Date: 14 December 2007
Expiration Date: 14 January 2008

**NEW YORK AND NEW JERSEY HARBOR DEEPENING**
**NEW YORK AND NEW JERSEY CHANNELS**
**FEDERAL NAVIGATION PROJECT**
**CONTRACT AREA S-AN-1b**

**TO WHOM IT MAY CONCERN:**

Pursuant to Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 (commonly referred to as the Ocean Dumping Act, 33 U.S.C. 1413), this Public Notice serves as the U.S. Army Corps of Engineers (New York District) notification and request for comments relating to the potential placement of HARS-suitable material obtained under the S-AN-1b construction contract of the New York and New Jersey Harbor Deepening Project, as authorized by Section 101(a)(2) of the Water Resources Act of 2000, Public Law 106-541. This proposed placement will allow predominantly Holocene sand to be placed at the Historic Area Remediation Site (HARS) and/or within Jamaica Bay for salt marsh restoration at Elders Point West Marsh Island under Section 204 (33 U.S.C. 2326) of the Water Resources Development Act of 1992 (Beneficial Uses of Dredged Material), as amended by Section 207 of the Water Resources Development Act of 1996 (33 U.S.C. 2326).

ACTIVITY: Deepen part of the Anchorage Channel, which is authorized as part of the NY & NJ Harbor Deepening project in Section 101(a)(2) of the Water Resources Act of 2000, Public Law 106-541 to -50 ft below mean low water with placement of up to 600,000 cubic yards of HARS-suitable remediation dredged material at the Historic Area Remediation Site. Potentially, about 190,000 cubic yards of the 600,000 cubic yards of HARS-suitable dredged material may be alternatively placed at Elders Point West Marsh Island within the Gateway National Recreation Area, Jamaica Bay, New York for salt marsh restoration, pending execution of project partnering agreements and receipt of needed funds.

LOCATION: Anchorage Channel, between Brooklyn and Staten Island, New York.

**DESCRIPTION OF PLANNED ACTION:**

The overall New York and New Jersey Harbor Project involves deepening 23.6 miles of navigation channel to depths of 50-53 feet below mean low water. Sixteen individual dredging contracts are planned to accomplish the deepening (see Figure 1). To date, five contracts have been awarded.

**Contract Area S-AN-1b**

Contract Area S-AN-1b (see Figure 2) contains predominantly Holocene sand that is to be dredged to a depth of –50 feet for the 50-foot project depth. To account for the inherent imprecision and variability in a dredging operation, the contractor is also paid for removing up to an additional 1.5 feet of material, below the required depth of –50 ft mean low water. Based on analyses of survey data from previous contracts, it is expected that the average dredged depth achieved will be approximately –51.5 feet. The majority of the individual survey points will likely be between –50.5 feet and –52.5 feet below mean low water. The predominantly Holocene sand is proposed to be used beneficially as HARS Remediation Material or, alternatively, for salt marsh restoration in Jamaica Bay. The table below summarizes the volumes of material proposed to be dredged from the Anchorage Channel, which is expected to take approximately two years to complete.

**Table A**
**Material Volume Estimates for the Anchorage Channel (to a total depth of –51.5')**

| Location of Material / Volume Estimates | HARS-Suitable Holocene Sediments Sand (CY) | Total Material Volume (CY) |
|---|---|---|
| S-AN-1b (Reach 1) | 410,000 | 600,000 |
| S-AN-1b (Reach 2) | 190,000 | |

The purpose of this Public Notice is to solicit comments regarding the proposed placement of dredged materials at the HARS and/or Jamaica Bay. These comments, along with all available technical data and information, will form the basis of a determination of whether this proposed project is in the public interest. The HARS (Figures 3 & 4), located in the Atlantic Ocean off the coasts of New York and New Jersey, is described later in this notice. Jamaica Bay (Figures 5 & 6) is located in Brooklyn, NY.

The proposed transportation of this dredged material for placement in ocean waters is being evaluated to determine that the proposed placement will not unreasonably degrade or endanger human health, welfare or amenities, or the marine environment, ecological systems or economic potentialities. The criteria established by the Administrator, USEPA, pursuant to Section 102(a) of the Ocean Dumping Act will be applied. In addition, consideration has also been given to alternatives other than placement of the dredged material in ocean waters.

The proposed placement has been reviewed based upon the "Biological Assessment for the Closure of the Mud Dump Site and Designation of the Historic Area Remediation Site (HARS) in the New York Bight and Apex" (USEPA, 1997) prepared pursuant to Section 7 of the Endangered Species Act (16 USC 1531). Based upon that review, and a review of the latest public listing of threatened and endangered species, it has been preliminarily determined that the proposed activity described herein is not likely to adversely affect any federally-listed threatened or endangered species

(humpback whales, finback whales, right whales, loggerhead turtles, leatherback turtles, green turtles, and Kemp's Ridley turtles) or their critical habitat.

The material proposed for HARS placement will not be placed within 0.27 nautical miles of any identified wrecks, indicated in the National Register of Historic Places. Other than wrecks, there are no known sites eligible for, or included in, the Register within the dredged material placement area. No known archaeological, scientific, pre-historical or historical data is expected to be lost by the anticipated placement of dredged material.

ALL COMMENTS REGARDING THIS ACTIVITY MUST BE PREPARED IN WRITING AND MAILED TO REACH THE NEW YORK DISTRICT, USACE AT THE OFFICE ADDRESS SHOWN ON THE FRONT PAGE OF THIS NOTICE, BEFORE THE EXPIRATION DATE OF THIS NOTICE. Otherwise, it will be presumed that there are no objections to the activity.

Any person who has an interest, or may be affected by the placement of this dredged material may request a public hearing. The request must be submitted in writing within the comment period of this notice and must clearly set forth the interest affected and the manner in which the interest may be affected by the proposed activity. It should be noted that information submitted by mail is considered just as carefully in the process and bears the same weight as that furnished at a public hearing.

**ENVIRONMENTAL DOCUMENTATION:**

The environmental impacts of the New York and New Jersey Harbor Deepening Project have been evaluated in accordance with the National Environmental Policy Act (NEPA) and other applicable regulations as presented in the following documents: (1) the Final Feasibility Report and Final Environmental Impact Statement dated December 1999; (2) the Final Limited Reevaluation Report and Final Environmental Assessment/Finding of No Significant Impact dated January 2004; (3) the Federal Record-of-Decision executed in June 2002. Copies of these documents can be viewed and/or obtained by contacting Mr. Harold Hawkins, Project Manager for the New York and New Jersey Harbor Deepening Project, at telephone number (917) 790-8204.

The environmental impacts of the beneficial use of dredged material to restore salt marsh habitat at Elders Point West Marsh Island has been evaluated in accordance with NEPA as presented in the *Integrated Ecosystem Restoration Report Environmental Assessment and Finding of No Significant Impact, Jamaica Bay Marsh Islands, Jamaica Bay, New York (December 2005).* The existing New York State Department of Environmental Conservation Permit Number 2-6405-00701/00004, included in Appendix B of the above document, will be modified for implementation of restoration at Elders Point West Marsh Island. The permit modifications will update the dredged material source and reference more detailed plans and specifications. Copies of these documents can be viewed and/or obtained by contacting Ms. Megan Grubb, Project Manager for the Elders Point West Marsh Island Restoration Project, at telephone number (917) 790-8618.

**HISTORIC AREA REMEDIATION SITE (HARS):**

In 1972, Congress enacted the Marine Protection Research and Sanctuaries Act (MPRSA) to address and control the dumping of materials into ocean waters. Title I of the Act authorized the US Environmental Protection Agency and the US Army Corps of Engineers to regulate dumping in

ocean waters. USEPA and USACE share responsibility for MPRSA permitting and ocean disposal site management. USEPA regulations implementing MPRSA are found at 40 CFR Sections 220 through 229. With few exceptions, MPRSA prohibits the transportation of material from the United States for the purpose of ocean dumping except as may be authorized by a permit issued under the MPRSA. The MPRSA divides permitting responsibility between the USEPA and USACE. Under Section 102 of the MPRSA, USEPA has responsibility for issuing permits for all materials other than dredged material. Under Section 103 of MPRSA, the Secretary of the Army has the responsibility for issuing permits for dredged material, subject to USEPA concurrence.

In the fall of 1997, the USEPA de-designated and terminated the use of the New York Bight Dredged Material Disposal Site (commonly known as the Mud Dump Site or MDS). The MDS had been designated in 1984 for the disposal of up to 100 million cubic yards of dredged material from navigation channels and other port facilities within the Port of New York and New Jersey. Simultaneous with the closure of the MDS, the site and surrounding areas that had been used historically as disposal sites for dredged materials were redesignated as the HARS (Figures 3 & 4) at 40 CFR Sections 228.15(d)(6) (See 62 Fed. Reg. 46142 (August 29, 1997); 62 Fed. Reg. 26267 (May 13, 1997)). The HARS is to be managed to reduce impacts of historical disposal activities at the site to acceptable levels in accordance with 40 CFR Sections 228.11(c). The need to remediate the HARS is supported by the presence of toxic effects, dioxin bioaccumulation exceeding Category 1 levels (a definition of which appears in an evaluation memorandum reviewing the results of the testing) in worm tissue, as well as TCDD/PCB contamination in area lobster stocks. Individual elements of those data do not establish that sediments within the Study Area are imminent hazards to the New York Bight Apex ecosystem, living resources, or human health. However, the collective evidence presents cause for concern, and justifies the need for remediation. Further information on the surveys performed and the conditions in the HARS Study Area may be found in the Supplemental Environmental Impact Statement (USEPA, 1997).

The HARS designation identifies an area in and around the former MDS that has exhibited the potential for adverse ecological impacts. The HARS will be remediated with dredged material that shall be selected so as to ensure it will not cause significant undesirable effects including through bioaccumulation or unacceptable toxicity, in accordance with 40 CFR 227.6. This dredged material is referred to as "Material for HARS Remediation" or "HARS Remediation Material".

The HARS, which includes the 2.2 square nautical mile area of the former MDS, is an approximately 15.7 square nautical mile area located approximately 3.5 nautical miles east of Highlands, New Jersey and 7.7 nautical miles south of Rockaway, New York. The former MDS is located approximately 5.3 nautical miles east of Highlands, New Jersey and 9.6 nautical miles south of Rockaway, New York. When determined by bathymetry that capping is complete, the USEPA will undertake any necessary rulemaking to de-designate the HARS.

To improve management and monitoring of placement activities at the HARS, electronic monitoring equipment is used on-board vessels carrying Remediation Material to the HARS. This equipment records vessel positions and scow draft throughout the duration of each trip to the HARS and during remediation operations. To improve communication reliability between tugs and scows, a prescribed formal communication procedure has been put in place (copies of this procedure are available upon request).

Additional information concerning the HARS can be obtained from Mr. Douglas Pabst of USEPA, Region 2, Team Leader of the Dredged Material Management Team, at telephone number (212) 637-3797.

## SEDIMENT TEST RESULTS

In accordance with the Ocean Dumping Regulations at 40 CFR Part 227, bioassays were performed to assess the toxicity of the solid phase, liquid phase and suspended particulate phase of the proposed dredged material from the project area. Bioassays were performed using appropriate sensitive marine organisms as discussed below. Bioassay testing conformed to procedures outlined in Evaluation of Dredged Material Proposed for Ocean Disposal (USEPA, USACE; 1991) commonly referred to as the "Green Book". The results of bioassay tests conducted on sediments from the project area are provided in Table 2 (A, B).

As depicted in Figure 2, the proposed dredging area has been characterized by using two (2) sediment testing reaches with 7 core samples in Reach 1 and 8 core samples in Reach 2. The core samples were taken to a depth of –51.5 feet (i.e., design depth of –50 feet plus an additional –1.5 feet allowable paid overdepth). The core samples in each reach were combined to yield two sediment composites, which were submitted to chemical and biological testing. Based upon an analysis of sediment samples from the reach, the grain size characteristics of the proposed dredged material are:

Reach 1: 0.39% GRAVEL, 89.37% SAND, 4.0% SILT, 6.24% CLAY

Reach 2: 0.37% GRAVEL, 85.57% SAND, 5.01% SILT, 9.05% CLAY

Results of the chemical and biological testing are summarized below.

### Evaluation of the Liquid Phase: Chemistry

In accordance with requirements of 40 CFR Sections 227.6(c)(1) and 227.27(a), chemical analysis was conducted on project area site water and elutriate. Results of this evaluation are summarized in Table 1 (A, B). (Please note the detection limits are shown for those constituents that the laboratory report as "not detected" (ND) in the concentration column. This reporting convention is also used in reporting the results of bioaccumulation potential testing discussed below).

Concentrations of chemical constituents in the water column following ocean placement, after allowing for initial mixing, were calculated using the Automated Dredging and Disposal Alternatives Management System (ADDAMS), a mixing model developed by the U.S. Army Corps of Engineers, Waterways Experiment Station (WES) and described in the joint USEPA/USACE manual referred to as the "Green Book". The material can be considered suitable for ocean disposal only if the concentration of the Suspended Particulate Phase (SPP) of the dredged material, after allowance for initial mixing, will not exceed the Limiting Permissible Concentration (LPC) beyond the boundaries of the disposal site within the first four hours following dumping or at any point in the marine environment after the first four hours. The ADDAMS Model predicted that applicable marine water quality criteria for listed constituents were not exceeded after allowance for initial mixing (40 CFR 227.29(a)). Results of the analyses indicate that the LPC will be met for the proposed dredged material from the project area.

**Bioassays**

In accordance with 40 CFR Part 227 of the Ocean Dumping Regulations, bioassays were performed to assess possible toxicity of the liquid, suspended particulate, and solid phases of the proposed dredged material from the project area.

Liquid phase bioassay. The results of the liquid phase bioassay indicated that none of the three sensitive marine organisms, mysid shrimp (*Mysidopsis bahia*), inland silversides (*Menidia beryllina*), and blue mussels (*Mytilus edulis*), after initial mixing (as determined under 40 CFR Sections 227.29(a)(2)), exceeded the toxicity threshold of 0.01 of a concentration shown to be acutely toxic to appropriate sensitive marine organisms. Accordingly, the liquid phase of the material is in compliance with 40 CFR Sections 227.6(c)(1) and 227.27(a).

Suspended particulate phase. The results of the suspended particulate phase conducted on the three sensitive marine organisms (mysid shrimp (*Mysidopsis bahia*), inland silversides (*Menidia beryllina*), and blue mussels (*Mytilus edulis*) indicated that dredged material in the suspended particulate phase would not exceed a toxicity threshold of 0.01 of a concentration shown to be acutely toxic in the laboratory bioassays, and thus would not cause significant mortality. Moreover, after placement, the suspended particulate phase would only exist in the environment for a short time, indicating that the suspended particulate phase of the project material would not cause significant undesirable effects, including the possibility of danger associated with bioaccumulation, since these impacts require long duration exposures (see USEPA, 1994). Accordingly, it is concluded that the suspended phase of the material from Anchorage Channel, Contract Area S-AN-1b, would be in compliance with 40 CFR Sections 227.6(c)(2) and 227.27(b). The results from the suspended particulate phase evaluation conducted on proposed dredged sediments from the project area are presented in Table 2 (A, B) of this Public Notice.

Solid phase. The solid phase evaluation tests the whole test sediment before it has undergone processing that might alter its chemical or toxicological properties. The reference sediment represents existing background conditions in the vicinity of the dumpsite, removed from the influence of any disposal operation. For the solid phase bioassay, 10-day toxicity was determined by exposing a filter feeding mysid shrimp (*Mysidopsis bahia*) and a deposit feeding, burrowing amphipod (*Ampelisca abdita*) to a composite of sediment from the project area and comparing mortalities in those treatments to mortalities experienced after exposure to a reference sediment. These organisms are good predictors of adverse effects to benthic marine communities (see USEPA, 1996a). Results are evaluated for biologically and statistically significant differences in mortality between treatments. The 1991 Green Book guidance considers that dredged material does not meet the whole sediment toxicity criterion when mortality in the test treatments is (a) statistically significant and greater than in the reference sediment and (b) exceeds mortality in the reference treatment by at least 10% for mysid shrimp and 20% for amphipod species. The following sections address the results of those tests and further analyze compliance with the regulatory criteria of 40 CFR Sections 227.6(c)(3), 227.27(b), and 228.15 and with USEPA, Region 2/New York District guidance.

The toxicity of project sediments was not statistically greater than reference for either mysids or amphipods, and the difference between percent survivals in test and reference sediments was less than 10% for mysid shrimp and less than 20% for amphipods. These results show that the solid

phase of the material would not cause significant mortality. The results of the toxicity portion of the solid phase bioassays can be seen in Table 2 (A, B).

**Evaluation of the solid phase bioaccumulation**

Bioaccumulation tests for sediments from the project area reaches were conducted on the solid phase of the project material for contaminants of concern using two appropriate sensitive benthic marine organisms, a sand worm (*Nereis virens*) and a bent-nosed clam (*Macoma nasuta*). These species are considered to be good representatives of the phylogenetically diverse base of the marine food chain.

Contaminants of concern, identified for the regional testing manual are listed in the NY/NJ Harbor Estuary Program Toxics Characterization report (Squibb, *et al.* 1991). Table 3 (A, B) of this notice addresses the bioaccumulation of contaminants of concern for the project area. Additional information on more rigorous evaluations conducted on individual contaminants may be found in the Testing Evaluation Memos for this project. Table 3 indicates that several contaminants in these reaches bioaccumulated above reference in the clam and/or worm. The Testing Memo further evaluates these contaminants and concludes that any contaminant that exceeded reference did not exceed any existing regional matrix or dioxin value. Several contaminants that do not have matrix values did exceed background levels, but in no case did any contaminant accumulate to toxicologically important concentrations, even when very conservative assumptions were used in the analysis. Any contaminants that exhibited bioaccumulation test results above reference were all below the acceptable human health risk range and acceptable aquatic effects range, again using conservative approaches and analyses.

Based on the requirements of 40 CFR Parts 227.6 and 227.27, bioaccumulation analyses were performed for the chemical constituents listed in Table 3 (A, B) of this Public Notice. All constituents identified in worm and clam tissue were compared to existing Food and Drug Administration (FDA) action levels for poisonous or deleterious substances in fish and shellfish for human food, regional disposal criteria, background concentrations and risk-based criteria provided by USEPA, Region 2.

**ALTERNATIVES TO HARS PLACEMENT:**

The New York District has evaluated the regional practicability of potential alternatives for dredged material disposal in a September 1999 Draft Implementation Report for the "Dredged Material Management Plan for the Port of New York and New Jersey". The Recommended Plan within the report addresses both the long and short term dredged material placement options in two specific timeframes, heretofore referred to as the "2010 Plan" and the "2040 Plan" respectively. The 2010 Plan relies heavily on the creation, remediation, and restoration of a variety of existing degraded or impacted sites in the region with material that would or would not be considered suitable for HARS remediation. The Plan anticipates that a considerable volume of HARS-suitable material will be placed at alternative beneficial use sites currently under development. Use of these sites performs habitat creation (for shellfish, oyster, and bird), habitat restoration at existing degraded pit sites, landfill and quarry remediation, provision of construction material, and beach nourishment. Many dredged material management options presented in the 2010 Plan are not presently permitted and/or are presently under construction, and are unavailable for the purposes of this notice. However, as alternative sites are developed and permitted, they may be evaluated and designated for use for the

remaining dredged material from the NY & NJ Harbor Deepening Project. As specific alternative sites and their applicable testing/regulatory criteria are subject to change, future Public Notices on the remaining NY & NJ Harbor Deepening Project contracts may be issued as evaluations and testing of the material to be dredged are performed and as other alternative placement sites are developed. This public notice addresses the potential for beneficial use placement of material at the Elders Point West Marsh Island to restore valuable salt marsh habitat in Jamaica Bay per Section 207 authority.

Based on bids received on 17 July 2007 for the Port Jersey PJ-3 contract, non-HARS suitable silt was going upland at costs varying from $61.35 per cubic yard to $79.95 per cubic yard, as compared to $5.50 per cubic yard for placement of silt at the HARS. This is an increase of $55.85 per cubic yard to $74.45 per cubic yard over the cost of placing the material at the HARS. The additional costs are to the United States and the Port Authority of New York and New Jersey.

Based on bids received on 24 August 2006 for S-AN-1a, non-HARS-suitable silt was going upland at costs varying from $52.45 per cubic yard to $71.00 per cubic yard. Sand placement at an upland site was bid at a range of $31 to $49 per cubic yard, and the sand/silt mixture was negotiated at a cost of $54 per cubic yard. Dredged material that is suitable for placement at the HARS as remediation material is estimated to be approximate to the PJ-3 cost of $5.50 per cubic yard, as indicated above.

S-AN-1b contract dredged material currently has no lower cost, economically viable alternative site for the HARS-suitable material. Placement at the HARS is considered the base plan for S-AN-1b. For example, disposal of sand from the Anchorage Channel S-AN-1a contract is $31 per cubic yard, as compared to a bid price of $5.50 per cubic yard for HARS-suitable material from the PJ-3 contract. The Corps will continue to evaluate all reasonable and beneficial alternatives, as practicable, that may become available during the advertisement and post advertisement periods of the contract. Optional placement of S-AN-1b dredged material at Elders Point West Marsh Island is not the least cost alternative; therefore, partnering agreements are required to cost-share the differential (incremental cost) of salt marsh restoration as compared to the base plan.

**Conclusion**

The USACE and the USEPA have determined that the material to be dredged meets the criteria for ocean placement as described in 40 CFR parts 227.6 and 227.27, and in USEPA, Region 2/USACE, New York District guidance. The material is also suitable for placement at the HARS as Remediation Material as described at 40 CFR Part 228.15.

Placement of this material at the HARS would serve to reduce impacts at the HARS to acceptable levels and improve benthic conditions. Sediments in the HARS have been found to be acutely toxic to sensitive benthic marine organisms in laboratory tests. Project dredged material subjected to laboratory acute toxicity tests with the same species was determined not to be toxic. Placement of project material over existing toxic sediments would serve to remediate those areas for toxicity. In addition, by covering the existing sediments at the HARS with this project material, surface dwelling organisms will be exposed to sediments exhibiting Category 1 qualities, which will ameliorate the existing sediment conditions.

Subject to partnering agreements and funding, the alternative placement of a portion of this material within Jamaica Bay at Elders Point West Marsh Island would restore approximately 34 acres of salt

marsh habitat. In addition to the restoration of natural function to degraded salt marsh habitat, the project would benefit the water quality and wildlife and fisheries conservation goals for Jamaica Bay.

Please contact Mr. Harold Hawkins, the NY & NJ Harbor Deepening Project Manager; at (917) 790-8204 or by email: Harold.J.Hawkins@usace.army.mil should you have any questions regarding this Public Notice or the NY & NJ Harbor Deepening Project in general. Comments or questions may be FAXED to (212) 264-2924.

For more information on New York District programs, visit our website at http://www.nan.usace.army.mil.

We request that you communicate the foregoing information concerning the proposed work to any persons known by you to be interested and who did not receive a copy of this notice.

for

William F. Slezak
Chief, Harbor Programs Branch

Enclosures

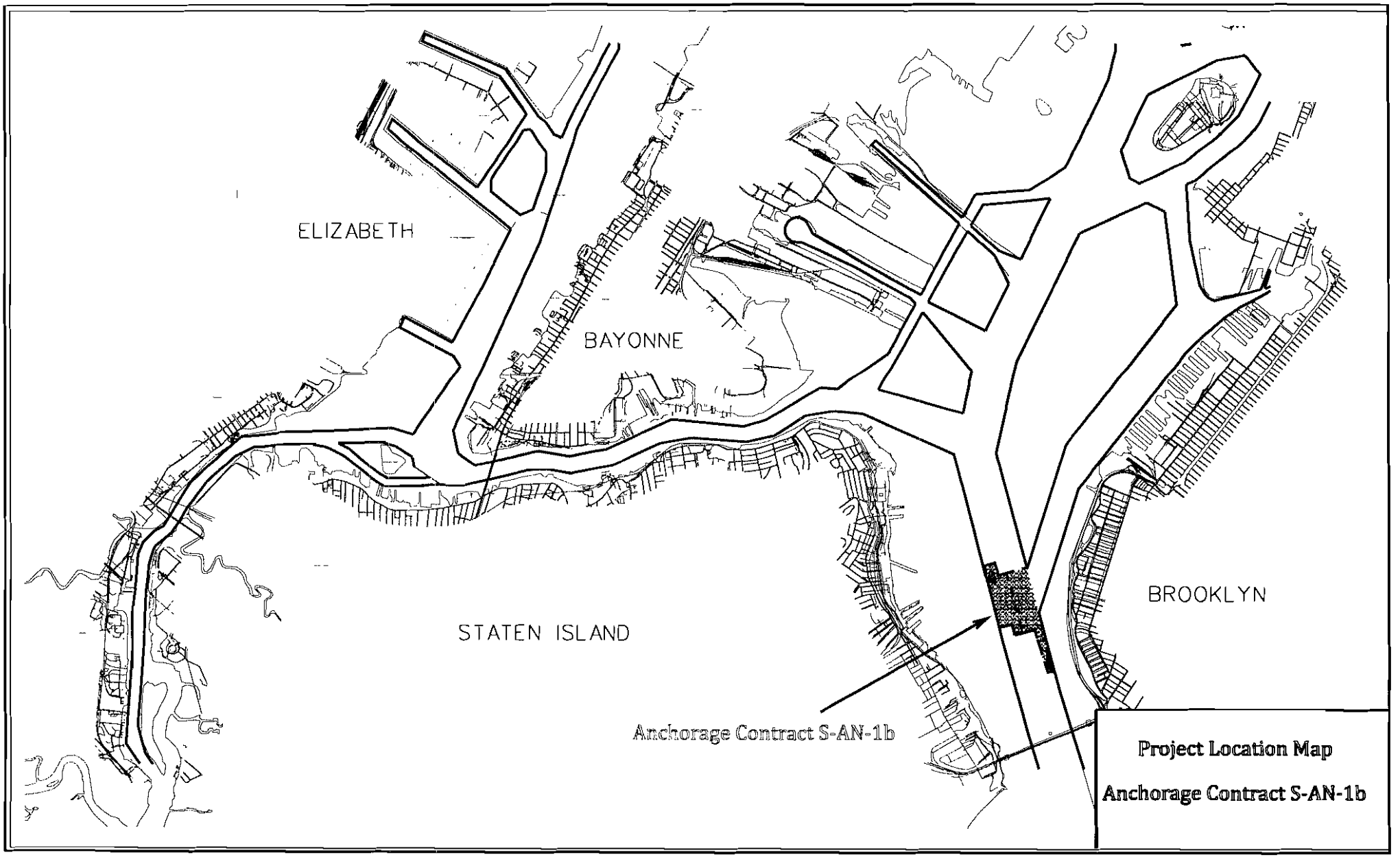
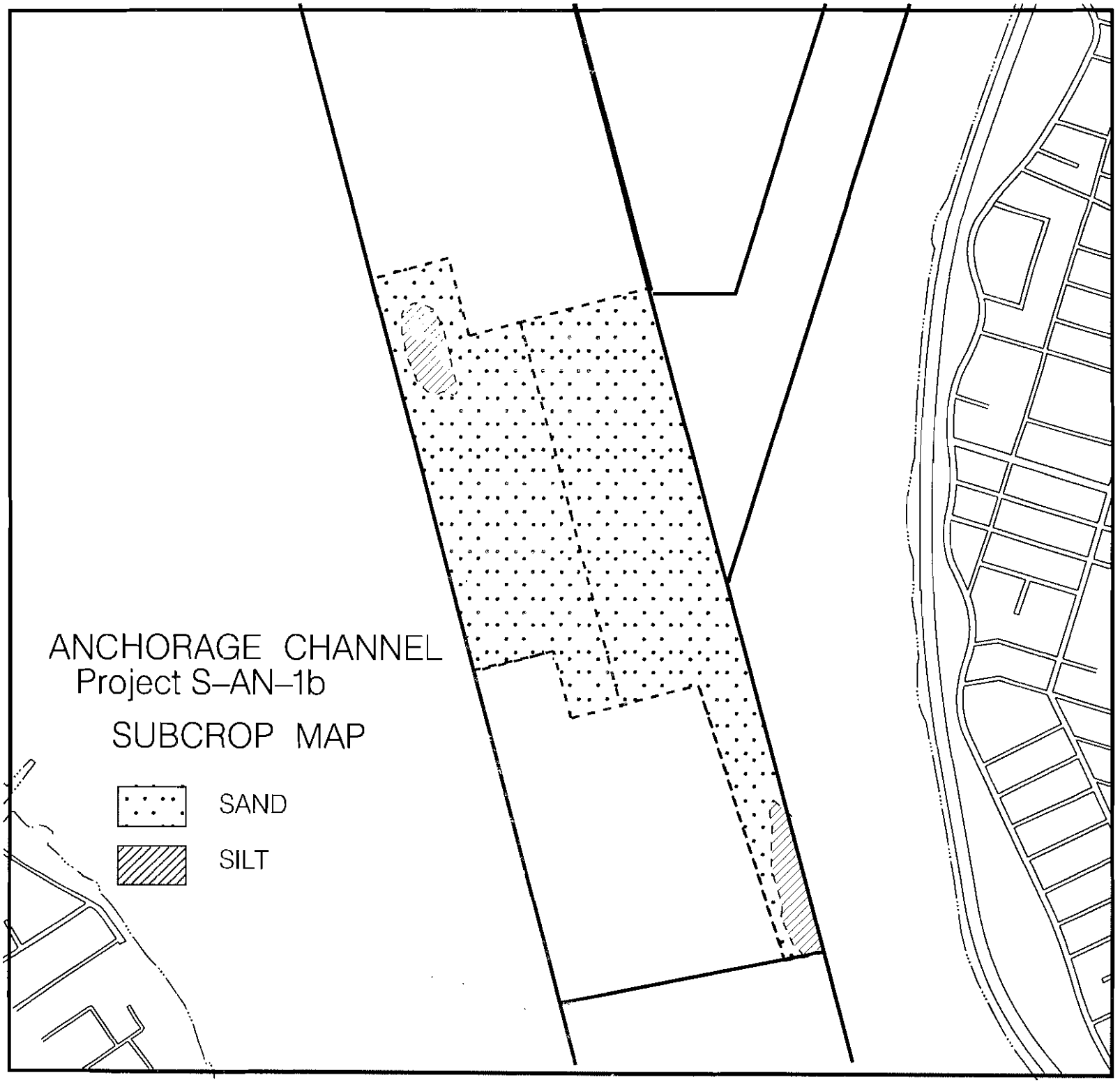
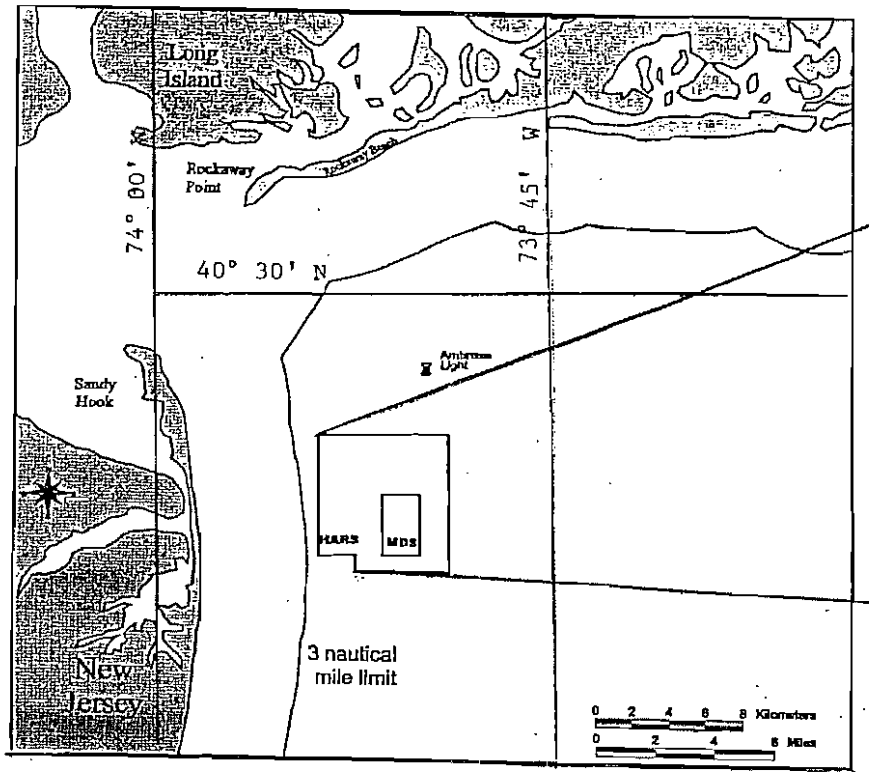

ELIZABETH
BAYONNE
STATEN ISLAND
BROOKLYN
Anchorage Contract S-AN-1b
Project Location Map
Anchorage Contract S-AN-1b

Figure 1

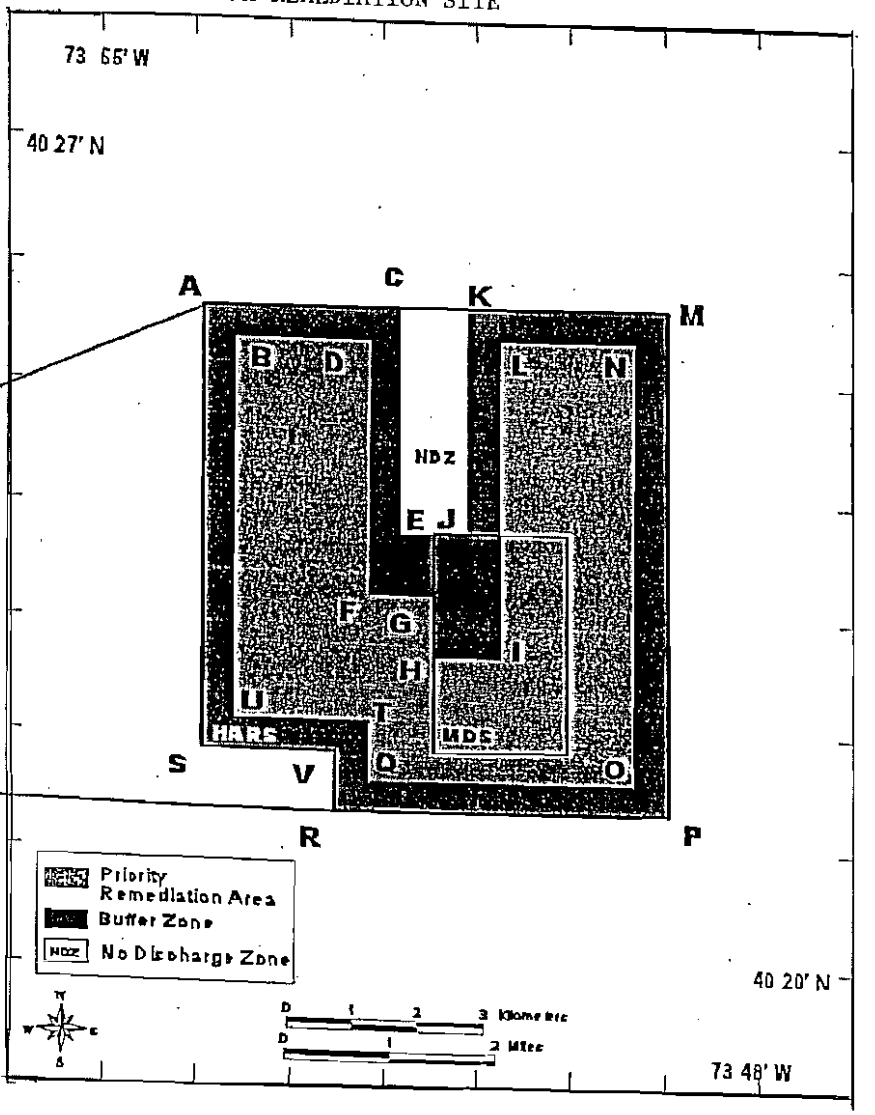

ANCHORAGE CHANNEL
Project S–AN–1b
SUBCROP MAP
SAND
SILT

HISTORIC AREA REMEDIATION SITE LOCATION MAP



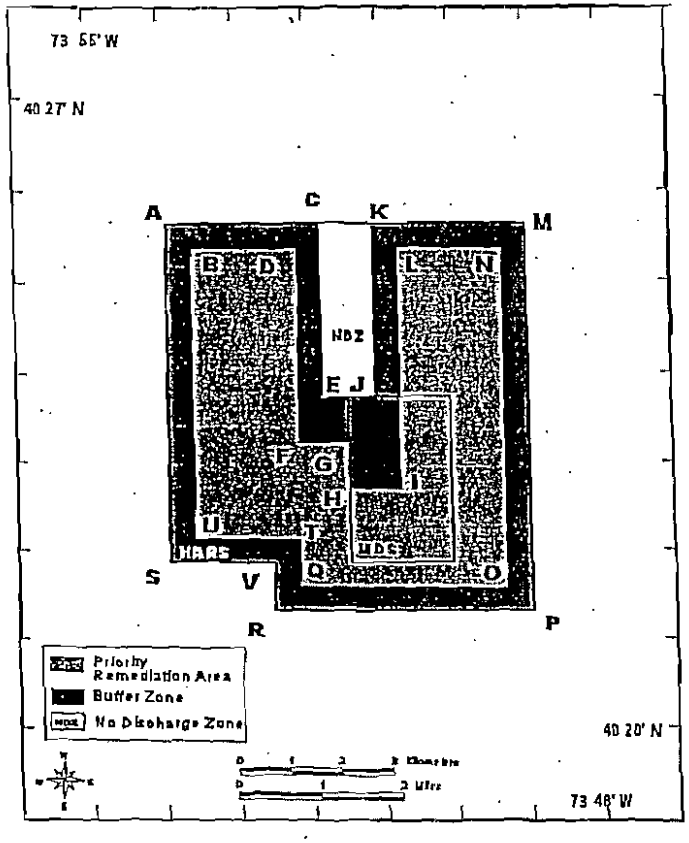

A

LOCATION OF PRIMARY REMEDIATION AREA WITHIN THE HISTORIC AREA REMEDIATION SITE




B

Figure 3




Priority Remediation Area (PRA): 9.0 square nautical mile area to be remediated with at least one meter of Remediation Material, bounded by the following coordinates:

| Point | Latitude DMS * | Longitude DMS | Latitude DDM ** | Longitude DDM |
|---|---|---|---|---|
| B | 40° 25' 23" N | 73° 53' 34" W | 40° 25.38' N | 73° 53.57' W |
| D | 40° 25' 22" N | 73° 52' 08" W | 40° 25.37' N | 73° 52.13' W |
| F | 40° 23' 13" N | 73° 52' 09" W | 40° 23.22' N | 73° 52.15' W |
| G | 40° 23' 13" N | 73° 51' 28" W | 40° 23.22' N | 73° 51.47' W |
| H | 40° 22' 41" N | 73° 51' 28" W | 40° 22.68' N | 73° 51.47' W |
| I | 40° 22' 41" N | 73° 50' 43" W | 40° 22.68' N | 73° 50.72' W |
| L | 40° 25' 22" N | 73° 50' 44" W | 40° 25.37' N | 73° 50.73' W |
| N | 40° 25' 22" N | 73° 49' 19" W | 40° 25.37' N | 73° 49.32' W |

* -- DMS = Degrees, Minutes, Seconds

** -- DDS = Degrees, Decimal Minutes

Figure 4

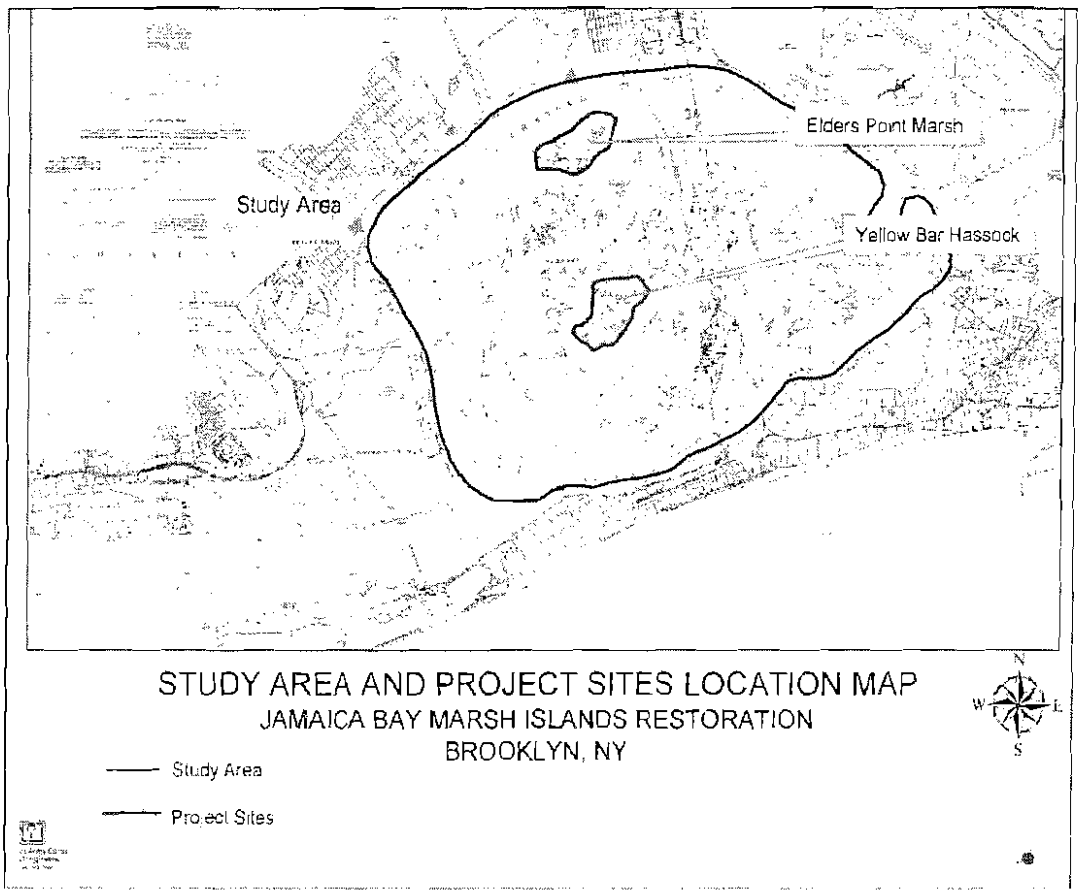

Elders Point Marsh
Study Area
Yellow Bar Hassock
STUDY AREA AND PROJECT SITES LOCATION MAP
JAMAICA BAY MARSH ISLANDS RESTORATION
BROOKLYN, NY
N
W
E
S
Study Area
Project Sites

Figure 5

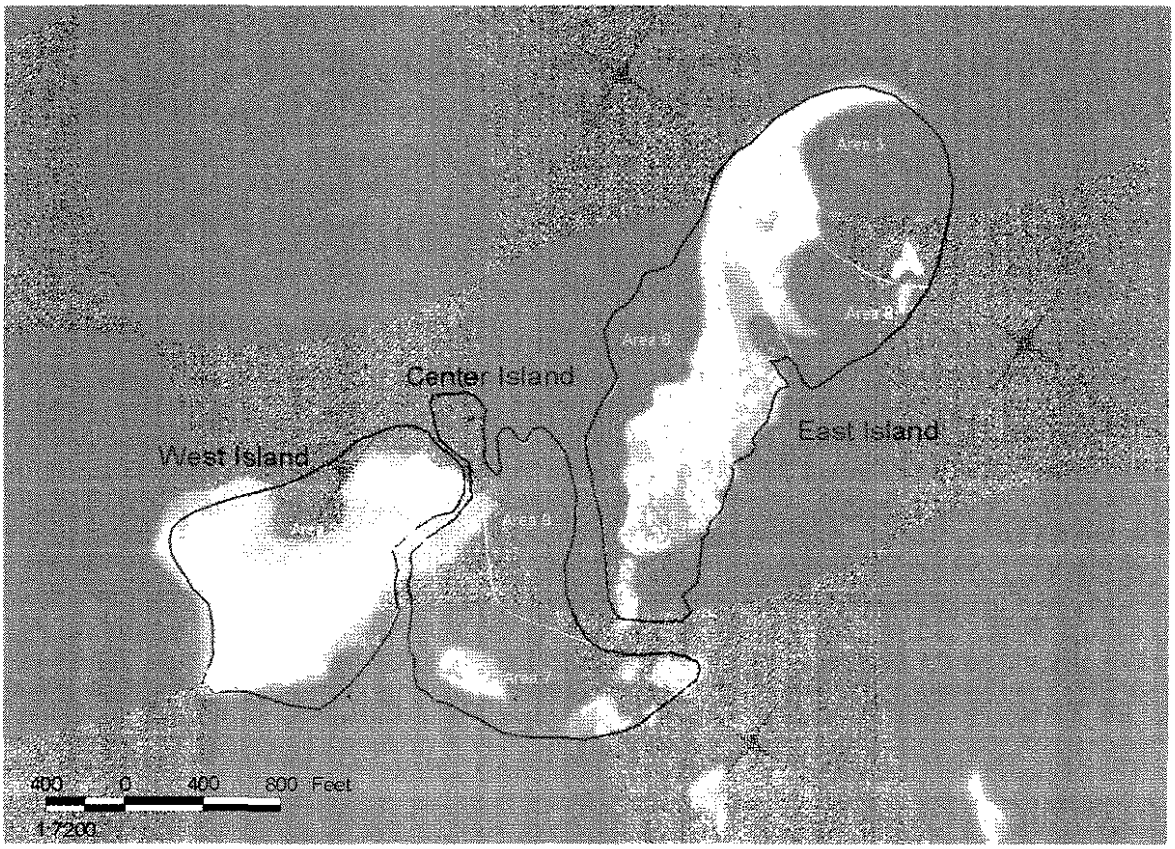

Area 3
Area 9
Center Island
West Island
East Island
Area 8
Area 2
400 0 400 800 Feet
1:7200

Figure 6

## TABLE 1A. RESULTS OF CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

### Anchorage Channel REACH 1

| | SITE WATER | | ELUTRIATE | |
|---|---|---|---|---|
| **CONSTITUENTS** | DETECTION LIMITS | CONCENTRATION | DETECTION LIMITS | CONCENTRATION |
| **Metals** | **ppb** | **ppb** | **ppb** | **ppb** |
| Ag | | 0.016 | | 0.008 |
| Cd | | 0.029 | | 0.007 |
| Cr | | 0.526 | | 0.622 |
| Cu | | 2.56 | | 0.867 |
| Hg | | 0.003 | | 0.003 |
| Ni | | 0.69 | | 0.79 |
| Pb | | 0.74 | | 0.59 |
| Zn | | 4.06 | | 2.08 |
| | | | | |
| **Pesticides** | **pptr (ng/L)** | **pptr (ng/L)** | **pptr (ng/L)** | **pptr (ng/L)** |
| Aldrin | 0.38 | ND | 0.38 | ND |
| a-Chlordane | 0 40 | ND | 0.40 | ND |
| trans Nonachlor | 0.40 | ND | 0.40 | ND |
| Dieldrin | 0.49 | ND | 0.49 | ND |
| 4,4'-DDT | 0 44 | ND | 0.44 | ND |
| 2,4'-DDT | 0.88 | ND | 0.88 | ND |
| 4,4'-DDD | 0.48 | ND | 0 48 | ND |
| 2,4'-DDD | 0 59 | ND | 0.59 | ND |
| 4,4'-DDE | 0 40 | ND | 0.40 | ND |
| 2,4'-DDE | 0 94 | ND | 0.94 | ND |
| **Total DDT** | | **1.9** | | **1.9** |
| Endosulfan I | 0 45 | ND | 0.45 | ND |
| Endosulfan II | 0 41 | ND | 0.41 | ND |
| Endosulfan sulfate | 0 41 | ND | 0 41 | ND |
| Heptachlor | 0 36 | ND | 0 36 | ND |
| Heptachlor epoxide | 0.89 | ND | 0 89 | ND |
| | | | | |
| **Industrial Chemicals** | **pptr (ng/L)** | **pptr (ng/L)** | **pptr (ng/L)** | **pptr (ng/L)** |
| PCB 8 | 0 51 | ND | 0.51 | ND |
| PCB 18 | 0 46 | ND | 0 46 | ND |
| PCB 28 | 0 38 | ND | 0 38 | ND |
| PCB 44 | 0.47 | ND | 0.47 | ND |
| PCB 49 | 0 34 | ND | 0.34 | ND |
| PCB 52 | 0 41 | ND | 0.41 | ND |
| PCB 66 | 0.47 | ND | 0.47 | ND |
| PCB 87 | 0.49 | ND | 0 49 | ND |
| PCB 101 | 0 83 | ND | 0.83 | ND |
| PCB 105 | 0.41 | ND | 0.41 | ND |
| PCB 118 | 0.50 | ND | 0.50 | ND |
| PCB 128 | 0 56 | ND | 0.56 | ND |
| PCB 138 | 0 48 | ND | 0.48 | ND |
| PCB 153 | 0 35 | ND | 0.35 | ND |
| PCB 170 | 0.64 | ND | 0.64 | ND |
| PCB 180 | 0.67 | ND | 0 67 | ND |
| PCB 183 | 0.44 | ND | 0.44 | ND |
| PCB 184 | 0 66 | ND | 0.66 | ND |
| PCB 187 | 0.40 | ND | 0.40 | ND |
| PCB 195 | 0.59 | ND | 0 59 | ND |
| PCB 206 | 0 44 | ND | 0.44 | ND |
| PCB 209 | 0.59 | ND | 0.59 | ND |
| **Total PCB** | | **16.14** | | **16.1** |

ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = sum of congeners reported x 2
Concentrations shown are the mean of three replicate analyses
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit

## TABLE 1B. RESULTS OF CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

### Anchorage Channel REACH 2

| | SITE WATER | | ELUTRIATE | |
|---|---|---|---|---|
| CONSTITUENTS | DETECTION LIMITS | CONCENTRATION | DETECTION LIMITS | CONCENTRATION |
| **Metals** | **ppb** | **ppb** | **ppb** | **ppb** |
| Ag | | 0.015 | | 0.004 |
| Cd | | 0.031 | | 0.012 |
| Cr | | 0.506 | | 0.426 |
| Cu | | 1.59 | | 0.930 |
| Hg | | 0.003 | | 0.002 |
| Ni | | 0.70 | | 0.60 |
| Pb | | 0.63 | | 0.30 |
| Zn | | 3 43 | | 2.35 |
| | | | | |
| **Pesticides** | **pptr (ng/L)** | **pptr (ng/L)** | **pptr (ng/L)** | **pptr (ng/L)** |
| Aldrin | 0.38 | ND | 0.38 | ND |
| a-Chlordane | 0.40 | ND | 0.40 | ND |
| trans Nonachlor | 0.40 | ND | 0.40 | ND |
| Dieldrin | 0.49 | ND | 0.49 | ND |
| 4,4'-DDT | 0.44 | ND | 0.44 | ND |
| 2,4'-DDT | 0.88 | ND | 0 88 | ND |
| 4,4'-DDD | 0.48 | ND | 0.48 | ND |
| 2,4'-DDD | 0.59 | ND | 0.59 | ND |
| 4,4'-DDE | 0.40 | ND | 0.40 | ND |
| 2,4'-DDE | 0.94 | ND | 0.94 | ND |
| **Total DDT** | | **1.9** | | **1.9** |
| Endosulfan I | 0.45 | ND | 0.45 | ND |
| Endosulfan II | 0.41 | ND | 0.41 | ND |
| Endosulfan sulfate | 0.41 | ND | 0.41 | ND |
| Heptachlor | 0.36 | ND | 0.36 | ND |
| Heptachlor epoxide | 0.89 | ND | 0.89 | ND |
| | | | | |
| **Industrial Chemicals** | **pptr (ng/L)** | **pptr (ng/L)** | **pptr (ng/L)** | **pptr (ng/L)** |
| PCB 8 | 0.51 | ND | 0.51 | ND |
| PCB 18 | 0.46 | ND | | 1.54 |
| PCB 28 | 0.38 | ND | | 1.7 |
| PCB 44 | 0.47 | ND | 0.47 | ND |
| PCB 49 | 0.34 | ND | 0.34 | ND |
| PCB 52 | 0.41 | ND | | 2.52 |
| PCB 66 | 0.47 | ND | | 1.30 |
| PCB 87 | 0.49 | ND | 0.49 | ND |
| PCB 101 | 0.83 | ND | | 0.78 |
| PCB 105 | 0.41 | ND | 0.41 | ND |
| PCB 118 | 0.50 | ND | | 1.15 |
| PCB 128 | 0.56 | ND | 0.56 | ND |
| PCB 138 | 0.48 | ND | 0.48 | ND |
| PCB 153 | 0 35 | ND | | 0.62 |
| PCB 170 | 0.64 | ND | 0.64 | ND |
| PCB 180 | 0.67 | ND | 0.67 | ND |
| PCB 183 | 0.44 | ND | 0.44 | ND |
| PCB 184 | 0.66 | ND | 0.66 | ND |
| PCB 187 | 0.40 | ND | 0.40 | ND |
| PCB 195 | 0.59 | ND | 0.59 | ND |
| PCB 206 | 0.44 | ND | 0.44 | ND |
| PCB 209 | 0.59 | ND | 0.59 | ND |
| **Total PCB** | | **16.14** | | **31.1** |

ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD DDE and DDT
Total PCB = sum of congeners reported x 2
Concentrations shown are the mean of three replicate analyses
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit

TABLE 2A. TOXICITY TEST RESULTS

Anchorage Channel REACH 1

**Suspended Particulate Phase**

| Test Species | Test Duration | $LC_{50}/EC_{50}$ | LPC (a) |
|---|---|---|---|
| ***Menidia beryllina*** | 96 hours | (b) >100% | >1 |
| ***Mysidposis bahia*** | 96 hours | (b) >100% | >1 |
| ***Mytilus edulis*** (larval survival) | 48 hours | (b) >100% | >1 |
| ***Mytilus edulis*** (larval normal develop.) | 48 hours | (c) >100% | >1 |

(a) Limiting Permissible Concentration (LPC) is the $LC_{50}$ or $EC_{50}$ multiplied by 0.01

(b) Median Lethal Concentration ($LC_{50}$) resulting in 50% mortality at test termination

(c) Median Effective Concentration ($EC_{50}$) based on normal development to the D-cell, prodissoconch 1 stage

**Whole Sediment (10 days)**

| Test Species | % Survival Reference | % Survival Test | % Difference Reference - Test | Is difference statistically significant? (a=0.05) |
|---|---|---|---|---|
| ***Ampelisca abdita*** | 90% | 99% | -9% | No |
| ***Mysidopsis bahia*** | 95% | 95% | 0% | No |

TABLE 2B. TOXICITY TEST RESULTS

**Anchorage Channel REACH 2**

**Suspended Particulate Phase**

| Test Species | Test Duration | $LC_{50}/EC_{50}$ | LPC (a) |
|---|---|---|---|
| ***Menidia beryllina*** | 96 hours | **(b)** >100% | >1 |
| ***Mysidposis bahia*** | 96 hours | **(b)** >100% | >1 |
| ***Mytilus edulis*** **(larval survival)** | 48 hours | **(b)** 87.1% | 0.87 |
| ***Mytilus edulis*** **(larval normal develop.)** | 48 hours | **(c)** 70.7% | 0.71 |

(a) Limiting Permissible Concentration (LPC) is the $LC_{50}$ or $EC_{50}$ multiplied by 0.01

(b) Median Lethal Concentration ($LC_{50}$) resulting in 50% mortality at test termination

(c) Median Effective Concentration ($EC_{50}$) based on normal development to the D-cell, prodissoconch 1 stage

**Whole Sediment (10 days)**

| Test Species | % Survival Reference | % Survival Test | % Difference Reference - Test | Is difference statistically significant? (a=0.05) |
|---|---|---|---|---|
| ***Ampelisca abdita*** | 90% | 98% | -8% | No |
| ***Mysidopsis bahia*** | 95% | 98% | -3% | No |

## TABLE 3A. 28 DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE
### Wet weight concentrations
### Anchorage Channel REACH 1

| CONSTITUENTS | *Macoma nasuta* | | | | *Nereis virens* | | | |
|---|---|---|---|---|---|---|---|---|
| | REFERENCE | | TEST | | REFERENCE | | TEST | |
| | DETECTION LIMITS | CONCENTRATION | DETECTION LIMITS | CONCENTRATION | DETECTION LIMITS | CONCENTRATION | DETECTION LIMITS | CONCENTRATION |
| **Metals** | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) |
| Ag | | 0.026 | | 0.025 | | 0 020 | | 0.013 |
| As | | 2 568 | | 2.732 | | 1 530 | | 1 244 |
| Cd | | 0 019 | | 0 019 | | 0 008 | | * 0.009 |
| Cr | | 0 148 | | * 0.249 | | 0.062 | | 0 066 |
| Cu | | 1 298 | | 1.320 | | 2 274 | | 2 324 |
| Hg | | 0 008 | | * 0.009 | | 0.004 | | 0 003 |
| Ni | | 0.265 | | * 0.404 | | 0 102 | | * 0.125 |
| Pb | | 0 152 | | * 0 286 | | 0.039 | | * 0 050 |
| Zn | | 9.270 | | 8.624 | | 11 350 | | 10.80 |
| **Pesticides** | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) |
| Aldrin | 0.03 | ND | 0.04 | ND | 0 04 | ND | 0.04 | ND |
| a-Chlordane | 0 03 | ND | 0 03 | ND | | 0.59 | | 0 58 |
| trans Nonachlor | 0 02 | ND | 0.02 | ND | | 0 90 | | 0 85 |
| Dieldrin | | 0 07 | | 0 08 | | 0 97 | | * 1 08 |
| 4,4'-DDT | 0.05 | ND | 0 05 | ND | | 0.07 | | * 0 11 |
| 2,4'-DDT | 0 05 | ND | 0.05 | ND | 0 05 | ND | 0.05 | ND |
| 4,4'-DDD | | 0.07 | | * 0 33 | | 0 35 | | * 0 73 |
| 2,4'-DDD | 0 03 | ND | | * 0 18 | | 0.48 | | * 0 74 |
| 4,4'-DDE | | 0 17 | | * 0.61 | | 0 15 | | * 0 36 |
| 2,4'-DDE | 0 10 | ND | | 0 05 | 0 10 | ND | 0 10 | ND |
| **Total DDT** | | **0.35** | | * **1.22** | | **1.14** | | * **2.01** |
| Endosulfan I | 0 11 | ND | 0.11 | ND | 0 11 | ND | 0 11 | ND |
| Endosulfan II | 0 03 | ND | 0.03 | ND | 0 03 | ND | 0.03 | ND |
| Endosulfan sulfate | 0.06 | ND | 0 06 | ND | 0 06 | ND | 0 06 | ND |
| Heptachlor | 0 04 | ND | 0 04 | ND | 0 04 | ND | 0 04 | ND |
| Heptachlor epoxide | 0 04 | ND | 0.04 | ND | | 0 24 | | 0 23 |
| | | | | | | | | |
| **Industrial Chemicals** | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) |
| PCB 8 | 0 31 | ND | 0 32 | ND | 0.32 | ND | 0 32 | ND |
| PCB 18 | | 0 06 | | * 0.08 | 0.06 | ND | 0.06 | ND |
| PCB 28 | | 0.03 | | * 0 10 | 0 03 | ND | 0.03 | ND |
| PCB 44 | | 0 04 | | * 0 09 | | 0 26 | | * 0 39 |
| PCB 49 | | 0 04 | | * 0.15 | 0 03 | ND | | * 0.13 |
| PCB 52 | | 0.09 | | * 0 30 | | 0 13 | | * 0.44 |
| PCB 66 | | 0 07 | | * 0 16 | | 0.09 | | * 0 14 |
| PCB 87 | | 0 04 | | * 0 12 | 0.07 | ND | | * 0.12 |
| PCB 101 | | 0 07 | | * 0 32 | | 0 59 | | * 0.78 |
| PCB 105 | | 0.02 | | * 0 07 | | 0.14 | | * 0.20 |
| PCB 118 | | 0 05 | | * 0.20 | | 0 23 | | * 0 36 |
| PCB 128 | 0.05 | ND | | * 0 04 | | 0 22 | | * 0.24 |
| PCB 138 | | 0 07 | | * 0 25 | | 1 40 | | * 1 53 |
| PCB 153 | | 0 08 | | * 0.30 | | 2 79 | | 2.75 |
| PCB 170 | | 0 05 | | 0 09 | | 0.31 | | 0 29 |
| PCB 180 | | 0 07 | | * 0 13 | | 0 89 | | 0 81 |
| PCB 183 | 0 03 | ND | | * 0 04 | | 0 39 | | 0 40 |
| PCB 184 | 0 02 | ND | 0 02 | ND | 0.02 | ND | 0 02 | ND |
| PCB 187 | 0 02 | ND | | * 0 05 | | 1 10 | | 1.08 |
| PCB 195 | 0.02 | ND | 0.02 | ND | | 0 24 | | 0 23 |
| PCB 206 | 0 02 | ND | 0 02 | ND | | 0 39 | | 0.38 |
| PCB 209 | 0.03 | ND | 0.04 | ND | | 0.23 | | 0 22 |
| **Total PCB** | | **2.04** | | * **5.38** | | **19.33** | | * **21.38** |
| 1,4-Dichlorobenzene | | 0 28 | | 0 30 | | 0 43 | | 0 31 |

**TABLE 3A. (Continued)** **Anchorage Channel REACH 1**

| CONSTITUENTS | *Macoma nasuta* | | | | *Nereis virens* | | | |
|---|---|---|---|---|---|---|---|---|
| | REFERENCE | | TEST | | REFERENCE | | TEST | |
| | DETECTION LIMITS | CONCENTRATION | DETECTION LIMITS | CONCENTRATION | DETECTION LIMITS | CONCENTRATION | DETECTION LIMITS | CONCENTRATION |
| **PAH's** | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) |
| Naphthalene | | 0.34 | | 0.40 | | 0 80 | | * 0.87 |
| Acenaphthylene | | 0.04 | | * 0 17 | | 0.13 | | * 0 22 |
| Acenaphthene | | 0.06 | | * 0.65 | | 0 29 | | * 2.26 |
| Fluorene | | 0 10 | | * 0.73 | | 0.18 | | * 0 39 |
| Phenanthrene | | 0.68 | | * 3.53 | | 0.46 | | * 1 00 |
| Anthracene | | 0 15 | | * 3 47 | | 0 08 | | * 0 38 |
| Fluoranthene | | 2.36 | | * 17.00 | | 0.64 | | * 7.02 |
| Pyrene | | 1 74 | | * 20 78 | | 0.26 | | * 6 51 |
| Benzo(a)anthracene | | 0.26 | | * 2.06 | | 0.03 | | * 0.27 |
| Chrysene | | 0.49 | | * 2.12 | | 0.05 | | * 0 34 |
| Benzo(b)fluoranthene | | 0.50 | | * 2.01 | | 0 08 | | * 0.30 |
| Benzo(k)fluoranthene | | 0 16 | | * 0.70 | | 0 03 | | * 0 13 |
| Benzo(a)pyrene | | 0 18 | | * 1.17 | | 0 03 | | * 0 16 |
| Indeno(1,2,3-cd)pyrene | | 0.06 | | * 0.31 | | 0 02 | | * 0.03 |
| Dibenzo(a,h)antracene | | 0 02 | | * 0 09 | | 0 02 | | 0 02 |
| Benzo(g,h,i)perylene | | 0 10 | | * 0.42 | | 0 05 | | * 0 06 |
| **Total PAH's** | | **7.24** | | * **55.60** | | **3.14** | | * **19.95** |
| | | | | | | | | |
| **Dioxins** | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) |
| 2378 TCDD | 0 60 | ND | 0.66 | ND | 0 59 | ND | 0 49 | ND |
| 12378 PeCDD | 1 51 | ND | 1 38 | ND | 0 90 | ND | 1 69 | ND |
| 123478 HxCDD | 0 95 | ND | 0.78 | ND | 0 46 | ND | 0 98 | ND |
| 123678 HxCDD | 0 93 | ND | 0.77 | ND | 0 46 | ND | | 0 50 |
| 123789 HxCDD | 0 90 | ND | 0 74 | ND | 0 44 | ND | 0 92 | ND |
| 1234678 HpCDD | 1 19 | ND | | 0.51 | | 0 47 | 0.97 | ND |
| 1234789 OCDD | | 1 58 | | * 3.81 | | 2 10 | | 1 21 |
| 2378 TCDF | 0.77 | ND | 0.76 | ND | | 0 73 | | 0 87 |
| 12378 PeCDF | 1 05 | ND | 0 87 | ND | 0 75 | ND | 1 18 | ND |
| 23478 PeCDF | 1 01 | ND | 0.89 | ND | 0 77 | ND | 1 19 | ND |
| 123478 HxCDF | 0.56 | ND | 0.42 | ND | 0 29 | ND | | 0 33 |
| 123678 HxCDF | 0.57 | ND | 0 45 | ND | 0 32 | ND | | 0 33 |
| 234678 HxCDF | 0 57 | ND | 0 47 | ND | 0 33 | ND | 0.76 | ND |
| 123789 HxCDF | 0 63 | ND | 0.51 | ND | 0 36 | ND | 0.83 | ND |
| 1234678 HpCDF | 0.91 | ND | 0.80 | ND | 0 64 | ND | 0 85 | ND |
| 1234789 HpCDF | | 0 50 | 0 86 | ND | 0 71 | ND | 0 88 | ND |
| 12346789 OCDF | | 0.73 | | 0.57 | 0 55 | ND | | 0.50 |

ND = Not detected
Total PAH = Sum of all PAH's
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
Concentrations shown are the mean of 5 replicate analyses in wet weight.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.
* = Statistically significant at the 95% confidence level

## TABLE 3B. 28 DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE
### Wet weight concentrations
### Anchorage Channel REACH 2

| CONSTITUENTS | *Macoma nasuta* | | | | *Nereis virens* | | | |
|---|---|---|---|---|---|---|---|---|
| | REFERENCE | | TEST | | REFERENCE | | TEST | |
| | DETECTION LIMITS | CONCEN TRATION | DETECTION LIMITS | CONCEN TRATION | DETECTION LIMITS | CONCEN TRATION | DETECTION LIMITS | CONCEN TRATION |
| **Metals** | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) | ppm (mg/kg) |
| Ag | | 0.026 | | 0.022 | | 0.020 | | 0.013 |
| As | | 2.568 | | * 2 876 | | 1 530 | | 1.388 |
| Cd | | 0.019 | | 0.021 | | 0 008 | | * 0.010 |
| Cr | | 0 148 | | * 0 200 | | 0 062 | | 0.068 |
| Cu | | 1 298 | | 1.216 | | 2 274 | | 2.274 |
| Hg | | 0.008 | | 0.008 | | 0.004 | | 0.003 |
| Ni | | 0 265 | | * 0 372 | | 0 102 | | * 0.138 |
| Pb | | 0.152 | | * 0.213 | | 0 039 | | * 0 047 |
| Zn | | 9.270 | | 8 934 | | 11 35 | | 8 63 |
| **Pesticides** | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) |
| Aldrin | 0.03 | ND | 0 04 | ND | 0.04 | ND | 0.04 | ND |
| a-Chlordane | 0 03 | ND | 0.03 | ND | | 0 59 | | 0 58 |
| trans Nonachlor | 0 02 | ND | 0.02 | ND | | 0.90 | | 0 90 |
| Dieldrin | | 0 07 | | 0.05 | | 0 97 | | 1 01 |
| 4,4'-DDT | 0 05 | ND | 0 05 | ND | | 0 07 | | 0 07 |
| 2,4'-DDT | 0 05 | ND | 0 05 | ND | 0 05 | ND | 0.05 | ND |
| 4,4'-DDD | | 0 07 | | 0.05 | | 0 35 | | 0 37 |
| 2,4'-DDD | 0 03 | ND | 0 03 | ND | | 0.48 | | 0 61 |
| 4,4'-DDE | | 0 17 | | 0 16 | | 0 15 | | 0 17 |
| 2,4'-DDE | 0.10 | ND | 0 10 | ND | 0 10 | ND | 0 10 | ND |
| **Total DDT** | | **0.35** | | **0.32** | | **1.14** | | **1.30** |
| Endosulfan I | 0 11 | ND | 0.11 | ND | 0 11 | ND | 0 11 | ND |
| Endosulfan II | 0 03 | ND | 0.03 | ND | 0 03 | ND | 0.03 | ND |
| Endosulfan sulfate | 0 06 | ND | 0 06 | ND | 0 06 | ND | 0 06 | ND |
| Heptachlor | 0 04 | ND | 0 04 | ND | 0 04 | ND | 0 04 | ND |
| Heptachlor epoxide | 0 04 | ND | 0 04 | ND | | 0 24 | | 0.24 |
| | | | | | | | | |
| **Industrial Chemicals** | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) |
| PCB 8 | 0 31 | ND | 0 32 | ND | 0 32 | ND | 0 32 | ND |
| PCB 18 | | 0 06 | | 0.06 | 0 06 | ND | 0 06 | ND |
| PCB 28 | | 0 03 | | * 0 05 | 0 03 | ND | 0.03 | ND |
| PCB 44 | | 0 04 | | 0 05 | | 0.26 | | 0 33 |
| PCB 49 | | 0.04 | | * 0 05 | 0.03 | ND | 0 03 | ND |
| PCB 52 | | 0 09 | | 0.08 | | 0 13 | | * 0.20 |
| PCB 66 | | 0 07 | | 0.05 | | 0.09 | | 0 08 |
| PCB 87 | | 0.04 | | 0 03 | 0.07 | ND | | 0 06 |
| PCB 101 | | 0 07 | | 0 05 | | 0 59 | | 0.65 |
| PCB 105 | | 0 02 | | 0.02 | | 0.14 | | 0 15 |
| PCB 118 | | 0.05 | | 0 05 | | 0.23 | | 0.24 |
| PCB 128 | 0 05 | ND | 0.05 | ND | | 0 22 | | 0.21 |
| PCB 138 | | 0 07 | | 0.05 | | 1.40 | | 1 41 |
| PCB 153 | | 0.08 | | 0 06 | | 2 79 | | 2 69 |
| PCB 170 | | 0 05 | | 0.06 | | 0 31 | | 0 29 |
| PCB 180 | | 0.07 | | 0.06 | | 0.89 | | 0.77 |
| PCB 183 | 0.03 | ND | 0 03 | ND | | 0 39 | | 0.40 |
| PCB 184 | 0 02 | ND | 0.02 | ND | 0 02 | ND | 0 02 | ND |
| PCB 187 | 0 02 | ND | 0.02 | ND | | 1 10 | | 1.08 |
| PCB 195 | 0 02 | ND | 0 02 | ND | | 0.24 | | 0.23 |
| PCB 206 | 0 02 | ND | 0 02 | ND | | 0 39 | | 0.39 |
| PCB 209 | 0 03 | ND | 0 04 | ND | | 0 23 | | 0 22 |
| **Total PCB** | | **2.04** | | **1.96** | | **19.33** | | **19.26** |
| 1,4-Dichlorobenzene | | 0.28 | | * 0 32 | | 0.43 | | 0 27 |

**TABLE 3B. (Continued)** **Anchorage Channel REACH 2**

| CONSTITUENTS | *Macoma nasuta* | | | | *Nereis virens* | | | |
|---|---|---|---|---|---|---|---|---|
| | REFERENCE | | TEST | | REFERENCE | | TEST | |
| | DETECTION LIMITS | CONCEN TRATION | DETECTION LIMITS | CONCEN TRATION | DETECTION LIMITS | CONCEN TRATION | DETECTION LIMITS | CONCEN TRATION |
| **PAH's** | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) | ppb (ug/kg) |
| Naphthalene | | 0.34 | | 0.39 | | 0 80 | | * 0.92 |
| Acenaphthylene | | 0 04 | | 0 04 | | 0.13 | | 0 13 |
| Acenaphthene | | 0.06 | | 0 12 | | 0.29 | | * 0 34 |
| Fluorene | | 0 10 | | * 0 17 | | 0.18 | | 0 21 |
| Phenanthrene | | 0 68 | | 0 83 | | 0 46 | | * 0 60 |
| Anthracene | | 0 15 | | 0.16 | | 0 08 | | 0 07 |
| Fluoranthene | | 2 36 | | 1.89 | | 0.64 | | * 1 12 |
| Pyrene | | 1 74 | | 1.62 | | 0 26 | | * 2 01 |
| Benzo(a)anthracene | | 0.26 | | 0 23 | | 0.03 | | 0.04 |
| Chrysene | | 0 49 | | 0 39 | | 0.05 | | * 0 06 |
| Benzo(b)fluoranthene | | 0.50 | | 0 37 | | 0 08 | | 0 07 |
| Benzo(k)fluoranthene | | 0 16 | | 0 12 | | 0 03 | | 0 03 |
| Benzo(a)pyrene | | 0.18 | | 0 15 | | 0 03 | | 0 02 |
| Indeno(1,2,3-cd)pyrene | | 0 06 | | 0 05 | | 0.02 | | 0 01 |
| Dibenzo(a,h)antracene | | 0 02 | | 0.02 | | 0 02 | 0 02 | ND |
| Benzo(g,h,i)perylene | | 0.10 | | 0 07 | | 0 05 | | 0 02 |
| **Total PAH's** | | **7.24** | | **6.64** | | **3.14** | | * **5.68** |
| | | | | | | | | |
| **Dioxins** | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) | pptr(ng/kg) |
| 2378 TCDD | 0 60 | ND | 0 71 | ND | 0 59 | ND | 0 70 | ND |
| 12378 PeCDD | 1 51 | ND | 1 30 | ND | 0 90 | ND | 0.95 | ND |
| 123478 HxCDD | 0 95 | ND | 0 59 | ND | 0 46 | ND | 0 74 | ND |
| 123678 HxCDD | 0 93 | ND | 0 57 | ND | 0 46 | ND | 0.73 | ND |
| 123789 HxCDD | 0 90 | ND | 0.56 | ND | 0 44 | ND | 0 71 | ND |
| 1234678 HpCDD | 1 19 | ND | 0 85 | ND | | 0 47 | 0 95 | ND |
| 1234789 OCDD | | 1.58 | | * 2 48 | | 2 10 | | 1 10 |
| 2378 TCDF | * 0 77 | ND | 0 69 | ND | | 0 73 | | 0 69 |
| 12378 PeCDF | 1 05 | ND | 0.88 | ND | 0 75 | ND | 0.82 | ND |
| 23478 PeCDF | 1 01 | ND | 0 90 | ND | 0.77 | ND | 0 84 | ND |
| 123478 HxCDF | 0 56 | ND | 0 44 | ND | 0 29 | ND | 0 64 | ND |
| 123678 HxCDF | 0 57 | ND | 0.45 | ND | 0 32 | ND | | 0 31 |
| 234678 HxCDF | 0 57 | ND | 0.48 | ND | 0 33 | ND | | 0.32 |
| 123789 HxCDF | 0 63 | ND | 0 51 | ND | 0 36 | ND | 0.70 | ND |
| 1234678 HpCDF | 0 91 | ND | 0 70 | ND | 0 64 | ND | 0.82 | ND |
| 1234789 HpCDF | | 0.50 | 0 77 | ND | 0 71 | ND | 0.81 | ND |
| 12346789 OCDF | | 0.73 | | 0 60 | 0 55 | ND | 1.07 | ND |

ND = Not detected
Total PAH = Sum of all PAH's
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
Concentrations shown are the mean of 5 replicate analyses in wet weight
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit
* = Statistically significant at the 95% confidence level